Grade 9 Investigation

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**AIM:** to be able to find solutions to the equation 7x+11y=100.

**Equation:** 7x+11y=100

**WORKING OUT:**

First, I will copy all the POSITIVE integers that are multiples of 7 in a column (X). I will only go up to 98 because they are positive numbers and for the sum to work both columns need to be less than 100. Afterwards, for each number on the X column, I sum the number needed to add up to 100. Then, I look to see if any of them are multiples of 11.

**X   Y**

7+93

14+86

21+79

28+72

35+65

Here 56 is a multiple of 7 and 44 is a multiple of 11, so the value of x is: 8 (because 56/7=8) and y: 4 (because 44/11=4)

42+58

49+51

56+44

63+37

70+30

77+23

84+16

91+9

98+2

Now, since the positive integers did not give me enough data to be able to make my rule, I will add make one column negative and one column positive. X (the multiples of 7) will be negative and Y (the multiples of 11 that I need to find) will be positive.

X    Y

-7+107

-140+249

-14+114

7(-3)+11(11) so the value of x-=-3 and Y =11

-21+121

-28+128

-35+135

-42+142

-49+149

-56+156

-63+163

-70+170

-77+177

-84+184

-91+191

-98/7=-14 (X=-14)

198/11=18 (Y=18)

-98+198

-105+205

-112+212

-119+219

-126+226

-133+233

-147+247

-154+254

-161+261

-168+268

-175/7=-25 (X=-25)

275/11=25 (Y=25)

-175+275

Now I will make Y negative (the multiples of 11) and list them first, and X positive and list them second.

Y X

-11+111

-22+122

-33/11=-3 (Y=-3)

133/7=19 (X=19)

-33+133

-44+144

-55+155

-66+166

-77+177

-88+188

-99+199

-110/11=-10 (Y=-10)

210/7=30 (X=30)

-110+210

-121+221

-132+232

-143+243

-154+254

-165+265

Now that I have finished my working out and have found enough solutions to find the rule, I will put them together and then order them.

**Solutions:**

7(8)+11(4)

7(-3)+11(11)

7(-14)+11(18)

7(-25)+11(25)

7(19)+11(-3)

7(30)+11(-10)

**In order:**

|  |  |
| --- | --- |
| X | Y |
| 30 | -10 |
| 19 | -3 |
| 8 | 4 |
| 3 | 11 |
| -14 | 18 |
| -25 | 25 |

I started organizing the X’s and their pairs, and realized that if the X’s went from biggest to smallest the Y’s go from smallest to biggest.

I chose 8 and 4 as the first pair of the sequence because they are the only pairs that are both positive, and they will help me to find the rule.

**THE RULE FOR X**

The difference between the X’s is -11, so the first part of the rule would be -11n. Since I chose 8 and 4 as the middle numbers, the difference between -11 and 8 (which is the x number) is 19. So, the rule is:

**-11n+19**

**THE RULE FOR Y**

The interval between the Y’s is +7; therefore the first part of the equation would be 7n. Since I chose 8 and 4 as the middle numbers, the difference between 7 and 4 (which is the y number) is -3. So, the rule is:

**7n-3**

**How can I prove this rule works?**

I’ll choose 3 random numbers and use them to prove my rule, by using my rule and seeing if the answer at the end is 100.

**Test 1:** 5

X: -11(5)+19= -36

Y: 7(5)-3= 32

7(-36)= -252

11(32)=352

252+325=100

**WOO IT WORKS!**

**Test 2:** -8

X: -11(-8)+19= 107

Y: 7(-8)-3= -59

7(107)= 749

11(-59)= -649

252+325=100

**It works!**

**Test 3:** 10

X: -11(10)+19= -91

Y: 7(10)-3= 67

7(-91)= -637

11(67)=737

-637+737=100

**It works too!**

My two rules worked!